IN THE CLAIMS:

The following is a complete listing of claims in this application.

1. (currently amended) A method of extracting in a vacuum (4) electrons emitted from a cathode ~~(2)~~ situated in spaced-apart relationship with an anode ~~(3)~~ which is placed at a given potential relative to the cathode by means of a bias source ~~(5)~~, the method comprising:

· making a cathode ~~(2)~~ presenting at least one junction ~~(9)~~ between a metal ~~(7)~~ serving as a reservoir of electrons and an n-type semiconductor ~~(8)~~, the ~~cathode presenting an electron emission surface (11)~~ junction possessing a surface potential barrier with a height ~~of a few tenths of an electron volt (eV)~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface for electrons and ~~presenting~~ having a thickness lying in ~~the~~ a range of 1 nm to 20 nm, defined by the value of the lowering desired for the surface potential barrier;

injecting electrons through the metal/semiconductor junction ~~(9)~~ to create a space charge ~~(Q)~~ in the semiconductor ~~(8)~~ sufficient to lower the surface potential barrier of the semiconductor to a value that is less than or equal to 1 eV relative to the Fermi level of the metal ~~(7)~~; and

· using the bias source ~~(5)~~ that creates an electric field in the vacuum to control the height of the surface potential barrier ~~(V_p)~~ of the n-type semiconductor, so as to modify in reversible manner the electron affinity of the n-type semiconductor surface in order to control the emission of an electron flux towards the anode.

2. (currently amended) A method according to claim 1, wherein the bias source ~~(5)~~ is controlled so as to create an electric field suitable for causing the height of the surface

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potential barrier ~~(V_p)~~ of the n-type semiconductor to be greater than the level of the states occupied by electrons in the n-type semiconductor so as to obtain an emission surface that does not emit electrons.

3. (currently amended) A method according to claim 1, wherein the bias source ~~(5)~~ is controlled so as to create an electric field suitable for causing the height of the surface potential barrier ~~(V_p)~~ of the n-type semiconductor to be substantially equal to the level of the states occupied by electrons in the n-type semiconductor, in order to obtain an emission surface having low electron affinity.

4. (currently amended) A method according to claim 1, wherein the bias source ~~(5)~~ is controlled so as to create an electric field suitable for causing the height of the surface potential barrier of the n-type semiconductor to be lower than the level of the states occupied by electrons in the n-type semiconductor so as to obtain an emission surface of negative electron affinity.

5. (currently amended) A method according to claim 1~~,~~ wherein the temperature of the cathode ~~(2)~~ is controlled in order to control the flux of the emitted electron beam.

6. (currently amended) A device for extracting in a vacuum ~~(4)~~ electrons emitted from a cathode ~~(2)~~ situated in a spaced-apart relationship with at least one anode ~~(3)~~ placed at a given potential relative to the cathode by means of a bias source ~~(5)~~, the device ~~being characterized in that it comprises~~ comprising:

· an emission cathode ~~(2)~~ having at least one junction ~~(9)~~ between a metal ~~(7)~~ and an n-type semiconductor ~~(8)~~, possessing a surface potential barrier with a height ~~of a few tenths of an electron volt~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface for

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electrons and possessing thickness lying in the range 1 nm to 20 nm defined by the value of the lowering desired for the surface potential barrier; and

· a bias source ~~(5)~~ creating an electric field in the vacuum ~~(4)~~ serving firstly to inject electrons through the metal/semiconductor junction ~~(9)~~ so as to create a space charge ~~(Q)~~ in the semiconductor ~~(8)~~ sufficient to lower the surface potential barrier of the semiconductor to a value that is less than or equal to 1 eV relative to the Fermi level of the metal ~~(7)~~, and also to control the height of the surface potential barrier of the n-type semiconductor, i.e. to reversibly modify the electron affinity of the surface of the n-type semiconductor in order to control electron flux emission.

7. (currently amended) A device according to claim 6, ~~characterized in that it includes~~ including an electron extraction electrode followed by an anode for receiving the extracted electrons.

8. (currently amended) An electron emission cathode for a device for extracting an electron beam in a vacuum in accordance with claim 6, the cathode ~~being characterized in that it comprises~~ comprising:

· a first portion forming an electron reservoir and constituted by at least one metal layer ~~(7)~~; and

· a second portion forming a conduction medium for the electrons injected into the metal layer and formed by an n-type semiconductor ~~(8)~~ co-operating with the metal layer to define a metal/semiconductor junction ~~(9)~~ possessing a potential barrier with a height ~~of a few tenths of an electron volt~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface ~~(11)~~ for the electrons, and possessing thickness lying in the range 1 nm to 20 nm defined

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by the value of the lowering desired for the surface potential barrier.

9. (currently amended) An emission cathode according to claim 8, ~~characterized in that~~ the ~~electron~~ metal/semiconductor junction possesses a potential barrier of height lying in the range ~~0.05 eV to 0.5 eV, and preferably~~ of approximately 0.1 eV.

10. (currently amended) A cathode according to claim 8, ~~characterized in that~~ wherein the first portion forming an electron reservoir is formed by a metal layer ~~(7)~~ carried on a substrate ~~(13)~~ of metal, semiconductor, or insulation.

11. (currently amended) A cathode according to claim 8, ~~characterized in that~~ wherein the n-type semiconductor ~~(8)~~ possesses an emission surface ~~(11)~~ for electrons that is substantially ~~plane~~ planar.

12. (currently amended) A cathode according to claim 8, ~~characterized in that~~ wherein the n-type semiconductor ~~(8)~~ possesses an emission surface ~~(11)~~ for electrons that presents projections ~~(14, 15)~~ enabling electron emission to be confined in register with each of them.

13. (currently amended) A cathode according to claim 11, ~~characterized in that~~ wherein the n-type semiconductor ~~(8)~~ possesses an emission surface ~~(11)~~ for electrons presenting projections ~~(14)~~ made in determined locations by lithographic techniques.

14. (currently amended) A cathode according to claim 11, ~~characterized in that~~ wherein the n-type semiconductor ~~(8)~~ possesses an emission surface for electrons presenting projections ~~(15)~~ in the form of points, obtained by ion bombardment of the metal layer deposited on an insulating substrate.

15. (currently amended) A cathode according to claim 8,

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~~characterized in that~~ wherein the first portion forming an electron reservoir is constituted by a metal layer ~~(7)~~ carried by a semiconductor substrate having active components arranged therein for locally controlling electron emission.

16. (currently amended) A cathode according to claim 10, ~~characterized in that~~ wherein the substrate ~~(13)~~ possesses an individual point shape or an individual pinhead shape for use in an individual electron gun.

Claims 17-18 (canceled).

19. (new) A method according to claim 1, wherein the metal-semiconductor junction possesses a potential barrier of height lying in the range of approximately 0.1 eV.

20. (new) A device according to claim 6, wherein the metal-semiconductor junction possesses a potential barrier of height lying in the range of approximately 0.1 eV.

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